Statistics in Schools

Correlation or Causation – Number of Employees and Annual Payroll

Description:

In this activity, students will use data from the 2007 Economic Census to analyze the differences between the concepts of causation and correlation.

Standard:

CCSS.Math.Content.HSS-ID.C.9:Distinguish between correlation and causation.

SECTORS OF THE ECONOMY, Number of Employees and Annual Payroll		
Sector of the Economy	Number of employees for pay period including March 12	Annual payroll ($1,000)
Mining, quarrying and oil and gas extraction	703,129	37,308,193
Utilities	632,432	50,893,874
Construction	7,399,047	348,138,262
Manufacturing	13,333,390	612,474,100
Wholesale trade	6,295,109	336,128,248
Retail trade	15,610,710	364,991,713
Transportation and warehousing	4,435,760	172,166,275
Information	3,428,262	223,376,793
Finance and insurance	6,562,546	494,484,693
Real estate and rental and leasing	2,309,725	88,880,642
Professional and scientific technical services	8,079,319	511,818,276
Administrative and support waste management remediation services	10,195,685	293,802,755
Educational services	562,210	14,584,076
Health care and social assistance	16,859,513	665,831,857
Arts, entertainment and recreation	2,070,524	57,545,590
Accommodations and food services	11,587,814	169,845,677
Other services (except public administration)	3,515,796	99,809,780
U.S. Census Bureau, 2007 Economic Census		

Activity Instructions for Students

How are an economic sector's number of employees and its payroll related? Does having a greater number of employees cause an economic sector to have a higher payroll?

The economic census is conducted every five years by the U.S. Census Bureau. It is the U.S. Government's official measure of American business and the economy. Forms go out to more than 4 million businesses, including large, medium and small companies representing all U.S. locations and industries. The results of the economic census provide the government with key source data for the Gross Domestic Product (GDP) and other indicators of economic performance.

In this activity, you will use data from the 2007 economic census to explore and discuss the difference in the concepts of **causation** and **correlation**. While **causation** indicates that two variables have a cause-and-effect relationship, **correlation** indicates that two variables are simply associated with each other.

Use the data table and your own knowledge to respond to the questions below. Before beginning, read and review the key terms provided below.

Sector of the Economy – an economic area in which businesses produce the same or a related product or service.

Number of Employees – refers to the number of paid employees.

Payroll – refers to the total compensation paid to all employees in a sector of the economy in a particular year.

Activity Assessment

1. Describe the relationship between number of employees and annual payroll.

The graph shows a positive linear relationship between a sector's number of employees and annual payroll.

2. Using the graph and data table, can you determine whether the relationship shows a correlation or causation in the data?

There is a correlation between annual payroll and number of employees. Without additional data, it is not possible to determine definitely whether the relationship between number of employees and annual payroll shows causation.

3. What argument could you give that the relationship between the variables is causal?

Students' answers will vary. More employees equals more money.

4. What argument could you give that the relationship between the variables is not causal?

Students' answers will vary. Companies cannot hire without more money and more money equals more employees.

Teacher's Notes

Learning Objectives

Students will be able to distinguish between correlation and causation.

Blooms Taxonomy

Analyzing

Instructions for Teachers

Before this Activity

If needed review the following terms and concepts:

- **Sector of the economy** – A group of related industries which follow similar processes and inputs to produce or provide their products or services**.**
- **Number of employees** – refers to the number of paid employees.
- **Annual payroll**- refers to the total compensation paid to all employees in a sector of the economy in a particular year.
- **Economic census** – conducted every five years by the U.S. Census Bureau, the economic census is the U.S. Government's official measure of American business and the economy. Forms go out to more than 4 million businesses, including large, medium and small companies representing all U.S. locations and industries. The results of the economic census provide the government with key source data for the Gross Domestic Product (GDP) and other indicators of economic performance.

- **Correlation coefficient** – a measure of strength and direction of the linear relationship between two variables.
- **Causation** – indicates that two variables have a cause-and-effect relationship, meaning that one *necessarily* causes the other.
- **Correlation** – the degree to which two or more attributes or measurements on the same group of elements show a tendency to vary together.

Causation is more difficult to prove than correlation.

Review the concepts related to the linear equation y=mx +b.

Depending on the needs of your own class and your approach, the questions for students in this activity may work best as a group discussion or in small groups.

During this Activity

If students are working in groups, monitor them as they working, making sure to address any mistakes or misconceptions.

After this Activity

Review students' responses as a whole group, clarifying and reinforcing the major points as you do so.